

CLAIMS

1. Method for the detection in a given DNA sequence of DNA mutations, single nucleotide polymorphisms, and insertions and deletions comprising the steps of:
  - 5 a) producing replicate(s) with an engineered polymerase of said given DNA sequence with at least 50% of one of the four natural DNA bases exchanged against a not natural base;
  - b) using said not natural base to cleave the replicate(s) obtained in step a) and to produce a DNA product presenting sequence-specific fragments;
  - 10 c) analyzing said sequence-specific fragments obtained in step b) by mass spectrometry to get sequence-specific fragment patterns; and
  - d) using the sequence-specific fragment patterns obtained in step c) to identify sequence changes relative to a reference to said given DNA sequence.
- 15 2. Method according to claim 1 wherein the not natural base in step a) is selected from the group consisting of an RNA base (ATP, GTP, CTP, or UTP), a phosphorothioate base, a phosphoroselenoate base, a photochemically cleavage inducible base.
- 20 3. Method according to claim 1 and 2 wherein in the replicate more than 70% of one of the four natural DNA bases is exchanged against a not natural base.
4. Method according to claim 3 wherein in the replicate 100% of one of the four natural DNA bases is exchanged against a not natural base.
- 25 5. Method according to claim 2 wherein the RNA base is cleaved in step b) by treatment with alkali and incubation at elevated temperature.
6. Method according to claim 2 in which the phosphorothioate or phosphoroselenoate base is cleaved in step b) by condensation of a compound of  
30 the nature  $\text{OH}-(\text{CH}_2)_n\text{-I}$ , where  $n=2-5$ , and incubation at elevated temperature.

7. Method according to claim 2 in which a photochemically cleavage inducible base is cleaved in step b) by exposure to light.
8. Method according to claim 1 wherein the step a) of producing replicate(s) is  
5 carried out with a procedure selected from the group consisting of the polymerase chain reaction (PCR) and the linear DNA copying procedure.
9. Method according to claim 8 wherein the linear copying procedure is a rolling circle replication.
10. Method according to claim 1 comprising further a step a') between step a) and  
10 step b), wherein in step a') the replicate(s) is purified, for example on reversed-phase material or with ion exchange resins.
11. Method according to claim 1 comprising further a step b') between step b) and  
15 step c), wherein in step b') the sequence-specific fragments are purified, for example on reversed-phase material or with ion exchange resins.
12. Method according to claim 1 wherein the mass spectrometer used for step c) is  
20 a MALDI or an ESI mass spectrometer.
13. Kit for the detection in a given DNA sequence of DNA mutations, single nucleotide polymorphisms, and insertions and deletions for implementing a method according to claim 1 comprising:  
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  - An engineered DNA polymerase,
  - A set of non-natural bases and dNTPs,
  - A buffer.